ATLSS SESI Documentation Sheet.

Draft v1.0 May 5, 2003

ATLSS SESI Model Number and Name

AT.GS1.1. American Alligator Spatially-Explicit Species Index Model

Justification

The American Alligator (*Alligator mississippiensis*) is a keystone species of the South Florida Ecosystem. Population growth and survival depends directly on the hydrologic functioning of South Florida watersheds. Although other endangered and keystone species occur within the ecosystem, the American Alligator's role as a top predator and its effect on the structuring of plant communities and associated aquatic animals make it an ideal indicator of ecosystem health. The response of alligator populations to spatio-temporal changes in hydrological conditions throughout the South Florida Ecosystem is integral to the evaluation of any restoration alternative.

The ATLSS American Alligator Production Index (API) Model was developed as a coarse indicator of the yearly production potential (probability of producing nests and offspring successfully) for the American Alligator in South Florida, based upon local habitat and hydrologic conditions. The API model addresses only the effects of relative local habitat quality and hydrological dynamics on production. Consequently, this model should not be interpreted as providing estimates of population dynamics or viability.

Spatial Constraints. - The spatial resolution for the model is 500x500 meters. Historical observations suggest that this roughly corresponds to the home range of nesting female alligators, so it is a useful scale of resolution. All data (water depth, vegetation type, ground elevation, breeding indices) represent values for a 500x500 meter area.

Temporal Constraints. - The temporal resolution for the model is one day for all water data (height and depth) and is static for the vegetation habitat types. The model produces a single yearly value for each spatial cell that takes account of the daily water data affecting the nesting and offspring production during that year.

CERP Target

Rather than specifying a single “performance measure” for each model, it is the objective of ATLSS to provide a rational basis for different stakeholders to determine their own criteria for comparing different hydrologic plans based upon their own choices of trade-offs between species, spatial regions and time horizons.

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Evaluation Protocol

Model Components

Breeding. - Water levels encountered during the period ranging from May 16 of the current nesting year to April 15 of the previous year are used as an indicator of the probability of breeding occurrence in an area. The probability that nesting will occur correlates positively with the amount of time spent in flooded conditions during this period. This model component is defined to be the proportion of this period for which water depth was greater than 0.5 feet. Biologists at ARM Loxahatchee NWR have suggested that a static value of 1.0 for this model component is appropriate for WCA 1.

Nest Construction. - Mean water depth during the peak of the mating season from April 16 through May 15 is used as an indicator of the probability that mating and nest construction will occur in a given area. Two linear functions are applied to define the value of this model component such that the highest probability of nest construction occurs at a mean level of 1.3 feet. Mean water depth values higher or lower than this reduce the probability of nest construction.

Nest Flooding. - The probability of a nest being flooding is calculated from a combination of mean water level during nest construction and maximum water level during egg incubation. Field observations indicate that the mean water level between June 15 and June 30 will determine the elevation at which a nest will be constructed. A linear function is applied to the difference between maximum water level during the egg incubation period (July 1through September 1) and mean water level during nest construction to give the probability of nest flooding. Biologists at ARM Loxahatchee NWR have suggested that a static value of 1 for this model component is appropriate for WCA 1.

Relative Habitat Quality - Available evidence suggests that the type of vegetative cover and elevation within an area greatly influence the probability of nesting. This model uses a static ranking of the dominant vegetation type within a 500-meter spatial cell as a measure of habitat quality.

Details of the SESI are available at: http://www.atlss.org/d_gator.html. We express the effects of proposed scenarios as changes in the spatial pattern of breeding potential over the model area. Our sub-area reporting units are based on a combination of public area, drainage basin, and management unit subregion maps, shown in http://:www.atlss.org/repunits.pdf).

Model output includes summary tables and three-panel maps displaying landscape results for (a) proposed hydrologic modification scenario on the left, (b) base scenario on the right, and (c) a cell-by-cell difference between index values for the two compared scenarios in the center panel, enabling the reader to make comparisons between alternatives.

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Source and History of Evaluation Protocol

The ATLSS modeling group has worked with field biologists to explore conceptual models and develop spatially-explicit species index models that reflect relationships between hydrologic factors and breeding/foraging potentials for key Everglades species. This SESI was one of 8 identified for development and was developed by Mark Palmer and Louis Gross, working with USGS/BRD biologist Ken Rice.

Selected References

Fleming, D. M. 1991. Wildlife Ecology Studies, Annual Report, South Florida Research Center, Everglades National Park, Homestead, Fl, V-10-1-52.

Kushlan, J. A. and T. Jacobsen. 1990. Environmental Variability and Reproductive Success of Everglades Alligators. J Herpetol. 24(2):176-184.

Mazzotti, F. J. and L. Brandt, 1994. Ecology of the American Alligator in a Seasonally Fluctuating Environment. Pgs:485-505 in S. M. Davis and J. Ogden (eds.) Everglades: The Ecosystem and Its Restoration. St. Lucie Press, Delray Beach, Fl.

http://www.atlss.org/d_overview.html

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